Science and Technology Hold Promise for Developing Countries in the 21st Century

In the 1960s, there was growing concern about rapidly increasing populations and low agricultural production in developing countries. This concern prompted increased research investments by private and public institutions, including the Rockefeller and Ford Foundations, to develop and implement new farming technologies and practices in many of these countries. By the late 1960s, the development and spread of high-yielding varieties of rice, wheat, and maize, combined with greater use of fertilizers and irrigation, led to the "Green Revolution," a period marked by notable increases in crop yields for the major grains. While the Green Revolution brought increased production to many parts of the developing world, some countries did not benefit as greatly. For example, relatively little research focused on such crops as yams, cassava, sorghum, and cowpeas—staples in many parts of Africa. As a result, yield gains have been distributed unevenly among crops and regions, hindering the ability of many developing countries to achieve income growth and provide sufficient food for their populations.

New developments in science and technology hold promise for increasing agricultural productivity in developing countries in the 21st century. A host of technological advances, realized through public and (increasingly) private investments in research and development, are increasing agricultural production in developed countries. These include improved technologies for nutrient, soil, water, and pest management; precision agriculture (such as the use of global positioning satellites in farming); and agricultural biotechnology. Advances in livestock breeding and veterinary science will increase both the quantity and quality of animal protein available to consumers. Crops and animals that can tolerate a wider range of environmental conditions and offer consumers desired characteristics, such as nutritional value and extended shelf life, are being developed. Innovations in biological and information sciences have resulted in several emerging fields—such as nanotechnology, which refers to the ability to manipulate individual atoms and molecules—that may form the foundation for new technologies that will be used to improve sustainable agricultural production and protect ecosystem functions.

But, without the dissemination and adoption of new technologies, the full benefits of scientific breakthroughs will not be realized in developing countries. Successful research and technology transfer activities increasingly will depend on cooperative endeavors between developed and developing countries and between public and private institutions. Developing countries must determine which technologies and advancements will address their unique economic, social, and environmental needs. And then these countries will benefit from working with developed countries and institutions to develop, adapt, and transfer productivity-increasing technologies to farmers in their countries.

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This finding is drawn from . . .

The ERS Briefing Room on Agricultural Research and Productivity: www.ers.usda.gov/briefing/agresearch/

U.S. Increasingly Imports Nitrogen and Potash Fertilizer

Nitrogen, phosphate, and potash are essential plant nutrients. U.S. farmers use about 21 million tons of these nutrients each year in the form of chemical fertilizers, helping to sustain high U.S. crop yields. But the sources of the nitrogen and potash have changed markedly in recent years from domestic to foreign suppliers, making the U.S. increasingly dependent on fertilizer imports.

Today the U.S. imports over half of the nitrogen and 80 percent of the potash fertilizer used on its farms. The picture is different for phosphate, most of which comes from domestic production.

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The changing levels and sources of fertilizer, which can be analyzed through a new database on the ERS website, have implications both for farmers and fertilizer providers. Farmers have benefited from lower nitrogen and potash prices because of the imports. But the competition has caused some U.S. fertilizer plants to close down. Also, the fertilizer distribution system has changed to accommodate the increasing imports.

The U.S. went from being the world's largest exporter of nitrogen fertilizer in the 1980s to becoming the largest importer in the 1990s. Domestic production of nitrogen fertilizer declined during the 1990s as the price of domestic natural gas (the primary source of nitrogen) increased because of demand for natural gas in the U.S. expanding faster than production. Imports of nitrogen—mainly from Trinidad and Tobago, Canada, and Russia, all with lower natural gas prices—quickly filled the gap.

The U.S. has long been a net importer of potash fertilizer. Domestic production of potash declined slightly in the late 1990s to less than 1 million tons per year, about one-fifth of domestic use. In the year ending June 2003, about 93 percent of potash imports came from Canada and 3 percent from Russia.

By contrast, the U.S. remains the world's largest exporter of phosphate fertilizer. The U.S. exported about 5 million tons (about half of total production) in the 12 months ending June 2003. About 37 percent of phosphate exports went to China, with smaller amounts to Australia, Canada, Brazil, Mexico, and other countries. But exports have declined by 25 percent since 1997 as production increased in other countries. Domestic use of phosphate has remained steady at just under 5 million tons per year.

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For more information on U.S. fertilizer imports and exports, visit www.ers.usda.gov/data/fertilizertrade/